REMARKS

Claims 1-20 are pending in the present application. Claims 1-4, 8, 11-14, 18 were canceled; claims 5, 9, 15, and 19 were amended; and claim 21 was added. Reconsideration of the claims is respectfully requested.

Amendments were made to the specification to correct errors and to clarify the specification. No new matter has been added by any of the amendments to the specification.

Also, applicants have submitted proposed corrections to drawings (Figure 10A) labeled "Prior Art" in red ink. These changes will be incorporated into a formal set of drawings upon approval of the proposed changes by the Examiner.

I. 35 U.S.C. § 112, Second Paragraph

The examiner has rejected claims 1-20 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter, which applicants regard as the invention. This rejection is respectfully traversed.

As per claims 1-20, the office action states:

> It is not clear from claims 1, 5, 11 and 15, what means "one fixed layer" since all the layers are fixed to a substrate or if they men fixed magnetically.

Therefore the rejection of claims 1-20 under 35 U.S.C. § 112, second paragraph has been overcome.

II. 35 U.S.C. § 102, Anticipation

The Examiner has rejected claims 5-10 and 15-20 under 35 U.S.C. § 102(e) as being anticipated by Pokhil (U.S. Pat. 6,181,533). This rejection is respectfully traversed.

As per claims 5-10 and 15-20, the office action states:

> Regarding claims 5 and 15, as far as it is understood, Pokhil discloses a reduced sensitivity spin valve sensor apparatus (figure 1), comprising:
>
> at least one fixed layer 50; and at least two free layers 54 and 62.
>
> Regarding claims 6 and 16, Pokhil shows at least one non-magnetic spacer 52 positioned between the at least one fixed layer 50 and one of the at least two free layers 54.
>
> Regarding claims 7 and 17, Pokhil shows that the at least one fixed layer includes at least two fixed layers 50 and 58 having a magnetic orientation approximately 90 degrees from a magnetic orientation of the at least two free layers.
>
> Regarding claims 8 and 18, Pokhil shows that the at least one fixed layer includes at least two fixed layers 50 and 58, and wherein the at least two free layers 54 and 62 are positioned between the at least two fixed layers.
>
> Regarding claims 9 and 19, Pokhil shows that the at least two fixed layers and the at least two free layers are spaced from one another by three non-magnetic spacers 52, 46, 60.
>
> Regarding claims 10 and 20, it is inherent in the reference to Pokhil that the magnetic flux is distributed across the two free layers to thereby reduce a magnetic flux fed to each free layer.

Analysis

Applicant respectfully submits that the claim rejections made by the Examiner in the Office Action of 03.27.03 are now moot in view of amendments made in this reply. Claim 5, for example, is reproduced for reference:

> 5. A reduced sensitivity spin valve sensor apparatus, comprising:
>
> at least one magnetically fixed layer; and
>
> at least two free layers;
>
> wherein the at least one magnetically fixed layer includes at least two magnetically fixed layers, and wherein the at least two free layers are positioned between the at least two fixed layers; and
>
> wherein the at least two magnetically fixed layers have a parallel magnetic orientation.

Claim 5 includes a limitation such that the magnetic orientations of the fixed layers are parallel to one another. This is not shown or suggested in any of the cited references.

Examiner had cited Pokhil against Claim 5, Figure 1, which shows dual spin valve sensors having free layers (52, 62) between two fixed layers (58, 50). However, the magnetizations of the two fixed layers in Pokhil are anti-parallel. This relative orientation between the two sensors is chosen by Pokhil to re-enforce their respective magnetic fields, as shown in FIG. 1A of Pokhil. Pokhil also discusses this at col. 6, lines 26-34:

> First current I1 flowing through first spin valve 42 will also generate magnetic field H1 upon second pinned layer 58, serving to further enforce the desired direction of magnetization Mp2 of second pinned layer 58. Similarly, second current I2 flowing through second spin valve 44 will generate magnetic field H2 upon first pinned layer 50, serving to further enforce the desired direction of magnetization Mp1 of first pinned layer 50.

Hence, if the two magnetization orientations of the fixed layers were not antiparallel as shown in Pokhil, re-enforcement of their respective fields could not be achieved, which is an object of Pokhil. FIG. 1A of Pokhil is shown below, depicting the reinforcing magnetic fields:

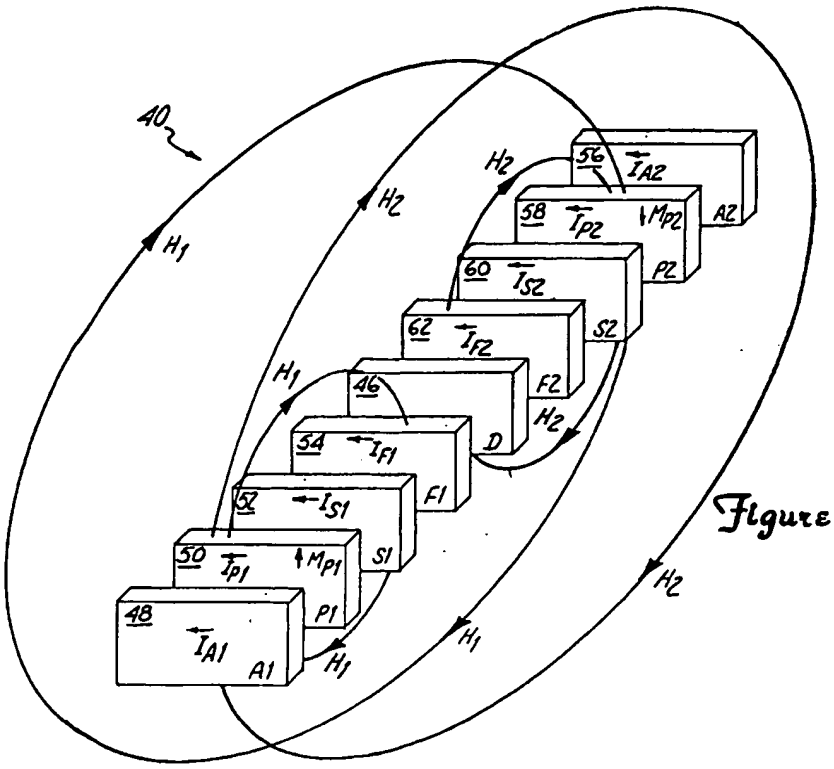

Figure 1 A

This figure depicts the reinforcing tendency of the fields of fixed layers with anti-parallel orientations. However, this re-enforcement of their respective fields also causes a decrease in their effect on the free layers, since the anti-parallel orientations will tend to cancel at the free layers, situated between them. This tends to retain sensitivity for the free layers.

However, an object of the present invention is to divide the flux between the two free layers, so as to reduce sensitivity of the spin valve apparatus and thus make it less susceptible to saturation. Saturation can occur on a spin valve sensor when older technologies are read. This is because older technologies use wider track widths to magnetically store data, and wider track widths produce more intense magnetic fields. The heightened sensitivity of spin valves, while useful for reading narrow (and thus low intensity) tracks makes typical spin valves susceptible to saturation.

The present invention is directed to reducing such saturation. Hence, re-enforcement of the magnetic orientations of fixed layers is not desired, and parallel orientations are claimed, as shown in claim 5, above.

Further, Applicant has submitted new claim 21, reproduced for reference:

21. A reduced sensitivity spin valve sensor apparatus, comprising:

first, second, third, and fourth ferromagnetic material layers being separated respectively from one another by three non-magnetic spacer layers, the first and fourth ferromagnetic material layers being outermost ferromagnetic material layers with respect to the second and third ferromagnetic material layers;

wherein the first and fourth ferromagnetic material layers have parallel fixed magnetization direction;

wherein the second and third ferromagnetic material layers have magnetization directions that can rotate when under applied magnetic fields;

wherein magnetic flux is spread across at least the second and third ferromagnetic material layers to thereby reduce the magnetic flux fed to the second and third ferromagnetic layers.

This claim includes limitations to "parallel fixed magnetization directions." As stated above, such elements are not taught or suggested by the cited references.

Hence, the rejection of claims 5-7, 9-10, 15-17, and 19-21 is believed overcome. Reconsideration of the claims is respectfully requested.

III. Conclusion

It is respectfully urged that the subject application is patentable over the cited references and is now in condition for allowance.

The Examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the Examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

DATE: 6.27.03

Respectfully submitted,

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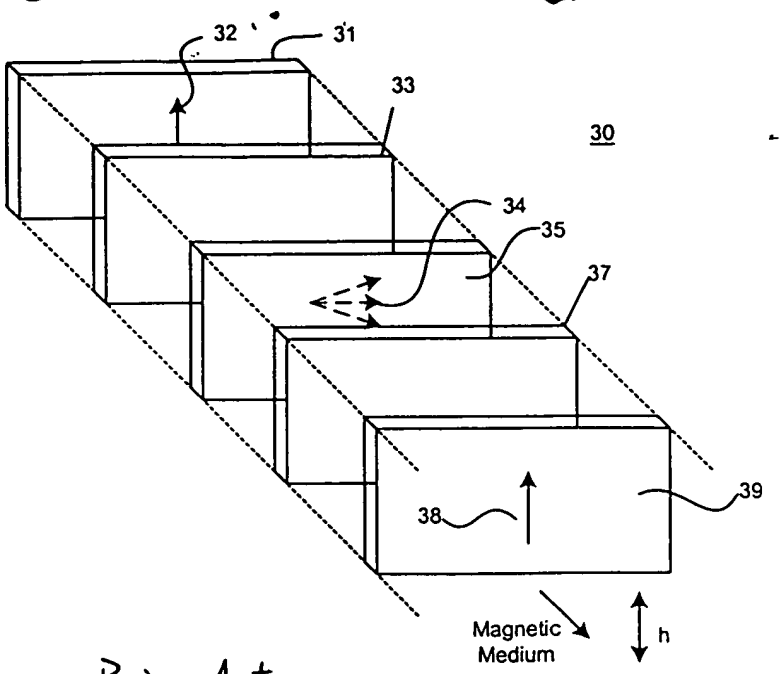

Prior Art

Figure 10A

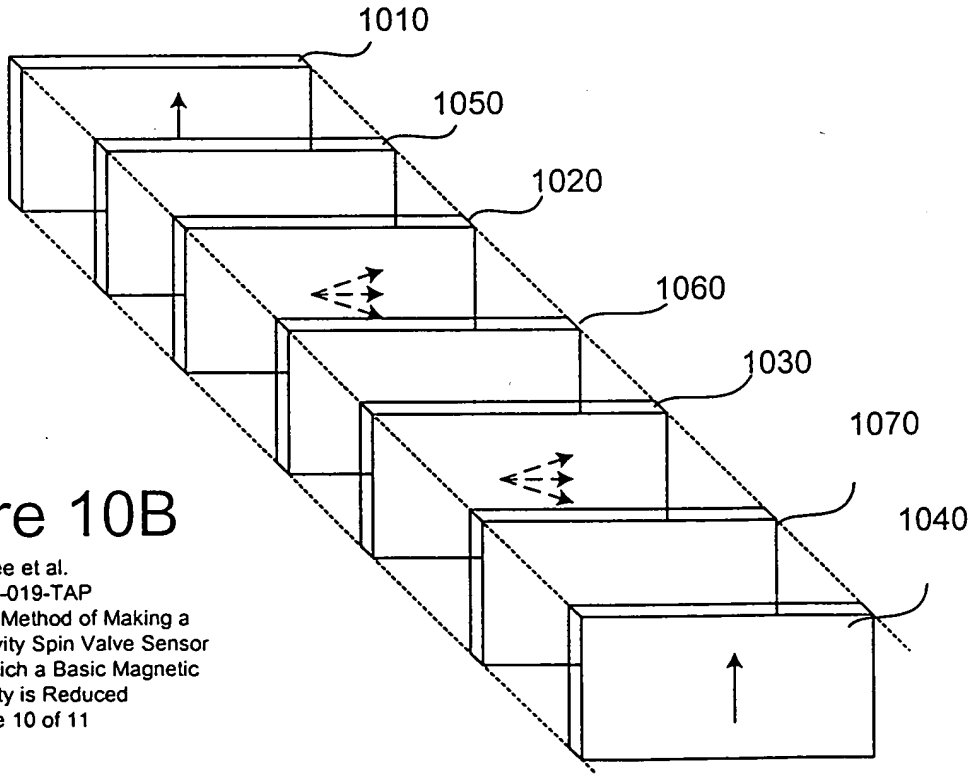

Figure 10B

Dee et al.
2001-019-TAP
Apparatus and Method of Making a
Reduced Sensitivity Spin Valve Sensor
Apparatus in which a Basic Magnetic
Sensitivity is Reduced
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